

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent No. : 7,282,102 Confirmation No. 2498
Inventor : CHOI et al.
Issued : October 16, 2007
Title : METHOD FOR MANUFACTURING HIGH SILICON GRAIN-
ORIENTED ELECTRICAL STEEL SHEET WITH SUPERIOR
CORE LOSS PROPERTY
Examiner : John P. Sheehan
Customer No. : 28289

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

ATTENTION: Decision and Certificate of Correction Branch
Patent Issue Division

REQUEST FOR CERTIFICATE OF CORRECTION OF PATENT
FOR PTO MISTAKE (37 C.F.R. 1.322(a))

Sir:

In accordance with 35 U.S.C. §254, we attach hereto Form PTO/SB/44 and a copy of proof of PTO errors and request that a Certificate of Correction be issued in the above-identified patent. The following errors appear in the patent as printed:

Column 5, line 42, "commercial operator" should read – commercial operation –
(See the Preliminary Amendment dated December 23, 2004, page 8, second replacement paragraph, line 6.)

Column 6, line 23, "the nitrizing step" should read – the nitriding step –
(See the Amendment dated April 9, 2007, page 4, first full replacement paragraph, line 10.)
(See also the marked-up pages of the application as filed.)

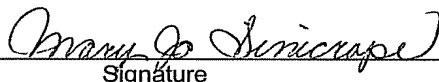
Respectfully submitted,
THE WEBB LAW FIRM

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I hereby certify that this correspondence is being
electronically submitted to the United States Patent and
Trademark Office on January 16, 2008.

01/16/2008
Date


Signature

Mary Jo Sinicrope
Typed Name of Person Signing Certificate

**UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION**

PATENT NO. : 7,282,102

Page 1 of 1

APPLICATION NO.: 10/519,521

ISSUE DATE : 10/16/2007

INVENTOR(S) : CHOI et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 5, line 42, "commercial operator" should read – commercial operation –

Column 6, line 23, "the nitriding step" should read – the nitriding step –

MAILING ADDRESS OF SENDER (Please do not use customer number below):

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This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Application No. Not Yet Assigned
Paper Dated: December 23, 2004
In Reply to USPTO Correspondence of N/A
Attorney Docket No. 1455-045724

Customer No. 28289

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. : Not Yet Assigned
Applicant : Kyu-Seung CHOI et al.
Filed : Concurrently Herewith
Title : METHOD FOR MANUFACTURING HIGH SILICON
GRAIN-ORIENTED ELECTRICAL STEEL SHEET
WITH SUPERIOR CORE LOSS PROPERTY
International Application : PCT/KR2003/002413
International Filing Date : 11 November 2003
Priority Dates Claimed : 11 November 2002 and 27 November 2002

MAIL STOP PCT
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

PRELIMINARY AMENDMENT

Sir:

Prior to initial examination, please amend the above-identified patent application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Abstract is on page 12.

Remarks begin on page 13 of this paper.

--In the present invention, the Si content in the Fe-Si-based sintered powder obtained as above is restricted to 25 - 70 wt%. If the Si content is less than 25wt%, it is so small and thus diffusion rate may be very slow. Also, the high density of the annealed powder may cause ~~the~~ a drop of the dispersion when the coating process is performed in practice. Since the content of Si exceeding 70wt% allows the main component to exist as FeSi₂ and a mixture of extra metal Si phase, the metal Si component contacts with the surface of material to increase the ~~creation~~ possibility of creating defects on the surface during the siliconizing process so that the control of the silicon content as siliconized may be difficult. In other words, by restricting the Si content contained in Fe-Si-based sintered powder to a range of 25 - 70 wt%, it is possible to manufacture Fe-Si-based composite compound sintered powder having FeSi₂, FeSi, Fe₅Si₃ or Fe₃Si as a main component. It is more preferable that the content of FeSi₂+FeSi among the Fe-Si-based composite compounds should be restricted to 90wt% or more with respect to the total weight of the sintered powder.--

Please replace the paragraph at page 13, beginning on line 8, with the following rewritten paragraph:

5 --When Fe-Si-based sintered powder manufactured as above is mixed with MgO powder and is used as the coating agent of electrical steel sheet, ~~this~~. This mixed powder is made in a slurry state and coated on the surface of the steel sheet by using a roll coater, which is most economical in commerical production-state. The Fe-Si-based sintered powder as the siliconizing agent should be made as fine as possible, ~~which~~. This enhances the coating workability in a production-stage commercial operation and is advantageous in terms of management of surface shape on the diffusion reaction. However, since the Fe-Si-based sintered powder where annealing reaction is completed is in a state of fused lump by a high temperature and long term reaction, it is necessary to control the grain size of the powder as fine as possible.--

10

Please replace the paragraph at page 13, beginning on line 22 and ending on page 14, line 7, with the following rewritten paragraph:

--Accordingly, the present invention ~~makes~~ requires that the grain size of the Fe-Si-based sintered powder ~~finely~~ be fine considering such a circumstance. ~~Finer~~ A finer

Appl. No. 10/519,521
Amdt. dated April 9, 2007
Reply to Office Action of 01/16/2007
Attorney Docket No. 1455-045724

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : 10/519,521 Confirmation No. 2498
Applicants : Kyu-Seung CHOI et al.
Filed : December 23, 2004
Title : Method for Manufacturing High Silicon Grain-Oriented
Electrical Steel Sheet with Superior Core Loss Property
Art Unit : 1742
Examiner : John P. Sheehan
Customer No. : 28289

" A "

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

Sir:

In response to the Office Action of January 16, 2007, please amend the above-identified application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 5 of this paper.

Remarks begin on page 7 of this paper.

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on April 9, 2007.

(Name of Person Mailing Paper)

Mariane Paull
Signature

04/09/2007
Date

temperature and long term reaction, it is necessary to control the grain size of the powder as fine as possible. --

Please replace the paragraph beginning at page 14, line 25, with the following rewritten paragraph:

5
10 -- As aforementioned, the invention utilizes the conventional manufacturing process of a grain-oriented electrical steel sheet including the steps of: producing a steel slab; reheating the steel slab; hot rolling the reheated steel slab; annealing the hot-rolled sheet and cold rolling the ~~anneal~~ annealed steel sheet to adjust the thickness of the steel sheet; decarburization annealing the ~~eled-rolled~~ cold-rolled steel sheet; performing a high temperature annealing of the steel sheet for a secondary recrystallization; and finish coating an insulating film. However, the invention is not limited to the above concrete manufacturing process. For instance, the inventive process may omit the ~~hot-rolled~~ hot-rolled sheet annealing step, or can be applied to a manufacturing process of an electrical steel sheet including the ~~nitriding~~ nitriding step together with the decarburization annealing. --

Please replace the paragraph beginning at page 20, line 21, with the following rewritten paragraph:

-- Next, one of the obtained ~~cold-rolled~~ cold-rolled steel sheets was coated with an annealing separator formed by adding 3% TiO₂ powder to 100 ~~part~~ parts by weight of MgO corresponding to the manufacturing condition of the conventional normal product, to manufacture a grain-oriented electrical steel sheet. The remaining ~~cold-rolled~~ cold-rolled steel sheets were coated with powder coating agents, which were dispersed in water and made in a slurry state and have different compositions and different grain sizes as shown in table 1, by using a roller coater. After that, these steel sheets were dried at a temperature below 700 °C and coiled to obtain large-sized coils. --

Please replace the paragraph beginning at page 25, line 6, with the following rewritten paragraph:

-- Next, siliconizing composition was formed ~~in-slurry~~ in a slurry state by mixing 25 ~~part~~ parts by weight of Fe-Si-based sintered powder having a grain size of -325mesh and containing 50% Si with 100 ~~part~~ parts by weight of MgO and then dispersing the mixture in water. The siliconizing composition was coated on the surfaces of the obtained decarburized annealed steel sheets by a roll coater. After that, the steel sheets were dried and coiled to obtain large-sized coils. --

METHOD FOR MANUFACTURING HIGH SILICON GRAIN-ORIENTED
ELECTRICAL STEEL SHEET WITH SUPERIOR CORE LOSS PROPERTY

TECHNICAL FIELD

5 The present invention relates to a method for manufacturing a high silicon grain-oriented electrical steel sheet that can improve magnetic properties, especially, ^a core loss characteristic, and more specifically, to a method for manufacturing a high silicon grain-oriented
PA 10 electrical steel sheet in which ^a powder coating agent containing an annealing separator for siliconization is coated on the surface of a steel sheet, and finished annealed to thereby ^{provide} ~~manufacture~~ an electrical steel sheet with outstanding high frequency magnetic properties as well
15 as outstanding commercial frequency properties.

BACKGROUND ART

Electrical steel sheets are generally classified into grain-oriented electrical steel sheet and non-oriented
20 electrical steel sheet. Grain-oriented electrical steel sheet contains 3% silicon (Si) and has a texture in which grains are oriented in an orientation $\{ (110) [001] \}$. Superior magnetic properties in the rolling direction allow these grain-oriented electrical steel sheet products to be
25 used as core material of transformers, motors, generators

contained in Fe-Si-based sintered powder to a range of 25 - 70 wt%, it is possible to manufacture Fe-Si-based composite compound sintered powder having FeSi_2 , FeSi , Fe_5Si_3 or Fe_3Si as a main component. It is more preferable that the content of $\text{FeSi}_2 + \text{FeSi}$ among the Fe-Si-based composite compounds should be restricted to 90wt% or more with respect to the total weight of the sintered powder.

When Fe-Si-based sintered powder manufactured as above is mixed with MgO powder and is used as ^{the} coating agent of electrical steel sheet, ^{sheet, this} this mixed powder is made in a slurry ~~state~~ and coated on the surface of the steel sheet by using a roll coater, which is most economical in ^{commercial} production ~~stage~~. The Fe-Si-based sintered powder as ^{the} siliconizing agent should be made as fine as possible. ^{This} which ^{enhances the coating workability in a commercial operation} ~~production stage~~ and is advantageous in terms of management of surface shape on ^{the} diffusion reaction. However, since the Fe-Si-based sintered powder where annealing reaction is completed is in a state of ^a fused lump by a high temperature and long term reaction, it is necessary to control the grain size of the powder as fine as possible.

Accordingly, the present invention ^{requires that} ~~makes~~ the grain size of ^{the} Fe-Si-based sintered powder ^{be fine} ~~finely~~ considering such a circumstance. ^{A finer} ~~Finer~~ grain enhances the dispersity toward slurry state and improves the coatability. Also, by coating

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conventional manufacturing process of a grain-oriented electrical steel sheet including the steps of: producing a steel slab; reheating the steel slab; hot rolling the reheated steel slab; annealing the hot-rolled sheet and
5 cold rolling the annealed steel sheet to adjust the thickness of the steel sheet; decarburization annealing the cold-rolled steel sheet; performing a high temperature annealing of the steel sheet for a secondary recrystallization; and finish coating an insulating film.

10 However, the invention is not limited to the above concrete manufacturing process. For instance, the inventive process may omit the hot-rolled sheet annealing step, or can be applied to a manufacturing process of an electrical steel sheet including the nitriding step together with the
15 decarburization annealing.

The invention does not limit the initial composition of the steel slab, but it is desirable that the steel sheet to be coated with the siliconizing powder coating agent in the form of slurry contains 2.9 - 3.3 wt% Si. If the Si
20 content is less than 2.9 wt%, core loss becomes severe, and if the Si content exceeds 3.3 wt%, the steel sheet is brittle so that cold rolling characteristic is very poor. More preferably, the steel sheet contains C: 0.045 - 0.062 wt%, Si: 2.9 - 3.3 wt%, Mn: 0.08 - 0.16 wt%, Al: 0.022 -
25 0.032 wt%, N: 0.006 - 0.008 wt%, remnant iron and